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EXAMINER	
MARTIN, MATTHEW T	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/589,691	DENG ET AL.	
	Examiner	Art Unit	
	MATTHEW T. MARTIN	4111	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-38* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-38* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *12/15/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status of Claims

1. Claims 1-38 are pending and are examined below.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 5 and 6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding Claims 5 and 6, Claims 5 and 6 contains the limitation “a first, second third and fourth scribing" adapted to remove portions. These limitations are unclear. Scribing, by definition, removes portions of the front and rear contacts or semiconductor material. From the claim language, these Claims fail to further limit the photoelectrode claimed.

Claim Rejections - 35 USC § 102

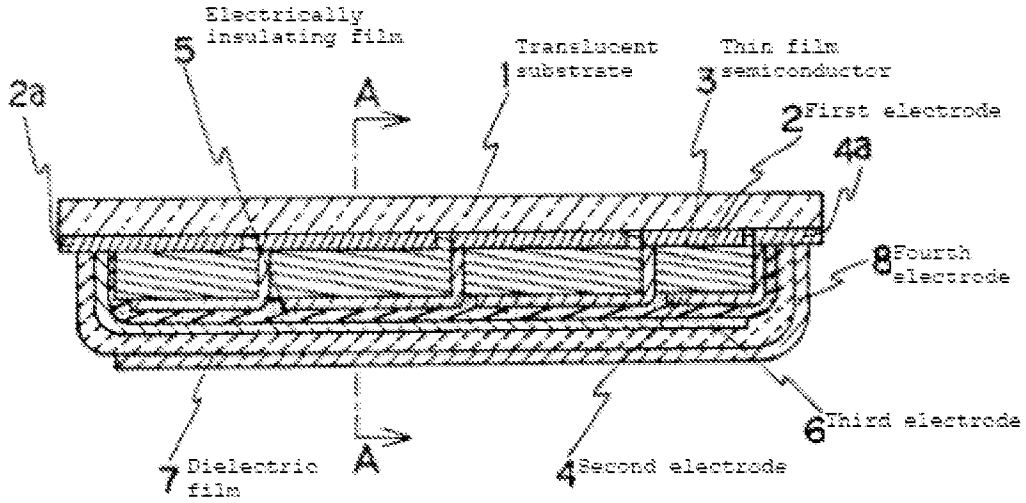
4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-5, 20 and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Owada et al, JP No. 62/092380 (refer to enclosed translation).

Regarding Claim 1, Owada et al. teaches a photoelectrode comprising:

Figure 1



A transparent, insulating substrate (1);

A front contact layer (2) comprising a transparent conducting layer deposited on the substrate as a first electrode (see page 6);

At least one of a single junction semiconducting pn or pin layers, or multiple junction stacked pin or pn (3) layers that generate photovoltaic voltage under illumination (see page 8);

A back contact layer which is electrically conductive to form a back electrode B (6).

An insulating layer (5) that covers portions of the back contact layer;

A conducting layer that is electrically connected to the transparent conducting layer (4); It is inherent that an electrode can function either as an anode or a cathode.

And oxygen evolution reaction layer to cover portions of the electrodes and to protect the photovoltaic cell from chemical and electrochemical corrosion (dielectric layer 7). Owada et al. teaches TiO_2 as a dielectric layer (see page 12). TiO_2 is taught as a potential oxygen evolution reaction layer in the present application, so the Examiner reads the oxygen evolution reaction layer as corresponding to the dielectric layer taught by Owada et al. Furthermore, the oxygen evolution reaction layer and the hydrogen evolution reaction layer are both optional in Claim 1; as such they need not be present in the current form of claim 1.

Regarding claim 2, Owada et al. teaches the layers separated into smaller area subcells, with each subcell containing both an anode and cathode (see fig. 1 and page 8).

Claims 3-6, 12, and 17 are considered product by process claims. Owada et al. teaches all of the positively recited structure of the claimed device. The determination of patentability is based on the device structure itself. The patentability of a product does not depend on a method of production or formation. If the product in the product by process claim is the same as or an obvious from a product in the prior art, the claim is unpatentable even though the prior art product was made by a different process. See MPEP 2113.

Regarding Claim 3, Owada et al. shows scribe lines (see fig. 1). Additionally, the scribe line limitation is read as a product by process limitation.

Regarding Claims 4 and 5, Owada et al. teaches the structure according to Claim 3. Owada et al. shows cell interconnection and removal of the contact layers and semiconductor layer (see fig. 1 and page 8).

Regarding Claim 20, Owada et al. teaches a method of making a photoelectrode comprising:

Selecting a substrate that is transparent and insulating (see fig. 1 and page 5. The example substances can be both transparent and insulating).

Forming a transparent conducting layer on the substrate as a front electrode (see fig. 1 and page 5).

Forming at least one of single-junction semiconductor pn or pin layers or multiple junction stacked pn or pin layers that generate photovoltage under illumination (see page 6).

Forming an electrically conductive back contact layer to form a back contact;

Forming an insulating layer that covers portions of the back contact

Forming a conducting layer that is electrically connected to the transparent conducting layer.

Forming and oxygen evolution reaction layer to cover all or portions of the anode or cathode to protect the photovoltaic cell from chemical or electrochemical corrosion (see fig. 1). Owada et al. teaches TiO_2 as a dielectric layer (see page 12). TiO_2 is taught as a potential oxygen evolution reaction layer

in the present application, so the Examiner reads the oxygen evolution reaction layer as corresponding to the dielectric layer taught by Owada et al. Furthermore, the oxygen evolution reaction layer and the hydrogen evolution reaction layer are both optional in Claim 20; as such they need not be present in the current form of claim 20.

Regarding Claim 21, Owada et al teaches the different layers separated into smaller area subcells (see fig. 1).

6. Claims 37 and 38 are rejected under 35 U.S.C. 102(b) as being unpatentable over Nakata et al., U.S. Patent No., 6,198,037.

Regarding Claim 37, Nakata et al teaches a photoelectrochemical cell comprising:

A photoelectrode (solar battery module 35);

An electrolyte, either acidic or alkaline in contact with an anode and cathode (see abstract, column 1, lines 30-35 and example 2). Furthermore, although example 2 specifies water as an electrolyte, plain water can inherently be acidic or alkaline;

Compartments for an oxidation reaction (33);

Compartments for a reduction reaction (32);

An ion conduction layer (partition member 3, comprising a polymer electrolyte that conducts ions);

An enclosure that confines the electrolyte for electrolysis (see fig. 1);

Regarding Claim 38, Nakata et al. teaches producing hydrogen using solar radiation (see example 2).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 6-19 and 22-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Owada et al. as applied to Claims 1 and 21 above, and in view of Delahoy, U.S. Patent No. 4,849,029.

Regarding Claim 6, Owada et al. does not specifically teach individual subcells that not generate enough voltage for water electrolysis.

Delahoy teaches individual subcells that do not generate enough voltage for electrolysis (see fig. 1 and column 5, lines 20-25). Additionally, Delahoy teaches that individual subcells can be connected to perform water electrolysis (see column 5, line 65 through column 6, line 7). Therefore, it would be obvious to modify the photoelectrode device taught by Owada et al. by selecting semiconducting materials that, although they do not generate enough voltage water electrolysis on their own, can generate enough voltage for water electrolysis when interconnected because of the necessity of low voltage/high current cells in photoelectrolysis applications (see column 2, lines 1-7).

Regarding Claim 7, Owada et al. teaches single and double junction solar cells (see pages 6 and 7).

Regarding Claim 8, Owada et al. teaches single junction thin film silicon solar cells (see fig. 1 and page 7).

Regarding Claim 9, Owada et al. teaches solar cells made from amorphous silicon (see page 7).

Regarding Claim 10, Owada et al. teaches single junction Cadmium Telluride (CdTe) solar cells (see page 7).

Regarding Claim 11, Owada et al. teaches double junction amorphous silicon and cadmium telluride solar cells (see page 8).

Regarding Claim 12, Owada et al. teaches an insulating layer that covers predetermined portions of the back contact (see fig. 1), along with a conducting layer electrically connected to the first electrode (see fig. 1). Additionally, the Examiner interprets the multijunction solar cells taught by Owada et al (see page 8) as capable of generating enough voltage for electrolysis because the Owada et al specification reads on Claim 13, which narrows claim 12 with respect to solar cell material.

Regarding Claim 13, Owada et al. teaches both triple junction solar cells and high voltage double junction solar cells (see page 8). The double junction solar cells are considered by the examiner to be high voltage.

Regarding Claim 14, Owada et al. teaches the photovoltaic cell comprising, among other things, amorphous silicon, and CdTe (see page 12).

Regarding Claim 15, Owada et al. teaches the anode or cathode adapted to extend beyond a surface of the photovoltaic cell and back contact (see fig. 1).

Regarding Claim 16, Owada et al. teaches the front electrode electrically connected to a separate conducting layer (see fig. 1).

Owada et al does not teach the connection via a segment between two scribes.

However, scribing is a method well known in the art for dividing photovoltaic and other semiconductor devices into subcells. For example, Delahoy teaches a photovoltaic device featuring arrays of photocells divided into

subcells with laser scribing (see column 1, lines 25-45). Additionally, Delahoy teaches a photoarray suitable for electrolysis applications (see column 5, line 45 through column 6, line 8).

Therefore, it would be obvious to one or ordinary skill in the art to modify the photoelectrode taught by Owada et al. by incorporating the scribing process as taught by Delahoy because Delahoy teaches that scribing is effective in dividing the cell components in the creation of a device suitable for electrolysis applications (see column 1, lines 25-45).

Regarding Claim 17, Owada et al. teaches solar cells that generate sufficient voltage for electrolysis. The examiner reads Owada et al., which includes a further limitation including triple junction solar cells as claimed below, to read on the limitation of Claim 17.

Regarding Claim 18, Owada et al. teaches triple junction and high voltage double junction solar cells (see page 12).

Regarding Claim 19, Owada et al. teaches the photovoltaic cell comprising, among other things, amorphous silicon, and CdTe (see page 12).

Regarding Claim 22, Owada et al. teaches a photoelectrode as described above. Owada et al. does not specifically teach dividing the cell with scribe lines.

However, scribing, which produces scribe lines, is a method well known in the art for dividing photovoltaics and other semiconductor devices into subcells. For example, Delahoy teaches a photovoltaic device featuring arrays of photocells divided into subcells with laser scribing (see column 1, lines 25-45).

Additionally, Delahoy teaches a photoarray suitable for electrolysis applications (see column 5, line 45 through column 6, line 8).

Therefore, it would be obvious to one or ordinary skill in the art to modify the photoelectrode taught by Owada et al. by incorporating the scribing process as taught by Delahoy because Delahoy teaches that scribing is effective in dividing the cell components in the creation of a device suitable for electrolysis applications (see column 1, lines 25-45).

Regarding Claim 23, Delahoy teaches separating the photoelectrode with laser scribing (see column 4, lines 20-35).

Regarding Claim 24, Delahoy teaches using scribing to: electrically isolate the front contact, remove portions of the thin film semiconductor layers, and remove portions of the back contact layer. These scribes correspond to the first, second, third, and fourth scribes claimed in claim 24. Furthermore, both Owada et al. and Delahoy teach forming a catalyst layer for electrolysis.

Regarding Claim 25, Owada et al. teaches the insulating layer covering predetermined areas of the back contact to protect surfaces from corrosion. Additionally, Owada teaches single junction solar cells which the Examiner reads as not generating enough voltage for electrolysis under illumination (see page 6).

Owada et al. does not specifically teach the fourth scribing.

Delahoy teaches a scribing applied to connect subcells, where the subcells generate sufficient voltage to drive water electrolysis (see column 5, line 45 through column 6, line 8).

Therefore, it would be obvious to one of ordinary skill in the art to modify the cell as taught by Owada et al. to apply the specific scribing as taught by Delahoy to connect two subcells together to have sufficient voltage to drive water electrolysis because scribing is a well known, cheap and available method of connecting unit cells in a photocell for water electrolysis.

Regarding Claim 26, Owada et al teaches single junction solar cells (see pages 6 and 7).

Regarding Claim 27, Owada et al teaches the use of single junction silicon based cells (see page 7).

Regarding Claim 28, Owada et al. teaches single junction cells of amorphous silicon (see page 7).

Regarding Claim 29, Owada et al. teaches single junction cells of Cadmium Telluride and amorphous silicon, among other things (see page 7).

Regarding Claim 30, Owada et al. teaches double junction amorphous silicon or cadmium telluride solar cells (see page 8).

Regarding Claim 31, Owada et al. teaches the insulating layer covering predetermined areas of the back contact to protect surfaces from corrosion. Additionally, Owada teaches multiple-junction solar cells which the Examiner reads as generating enough voltage for electrolysis under illumination.

Regarding Claim 32, Owada et al. teaches triple junction solar cells (see page 8).

Regarding Claim 33-36, Owada et al. teaches a double, triple, or quadruple junction cell featuring, among other materials, CdTe and amorphous silicon (see page 8).

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Glatfelter et al., U.S. Patent No. 5,468,988 teaches a photovoltaic device that can be used in water electrolysis comprising electrode layers, active layers and subcells with interconnection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW T. MARTIN whose telephone number is (571)270-7871. The examiner can normally be reached on 8:30 to 6:00 EST Monday through Thursday and on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen, can be reached on (571)272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MATTHEW T MARTIN/
Examiner, Art Unit 4111
20 April 2009